

CTE-Matched, Liquid-Cooled, High Thermal Conductivity Heat Sink, Phase I

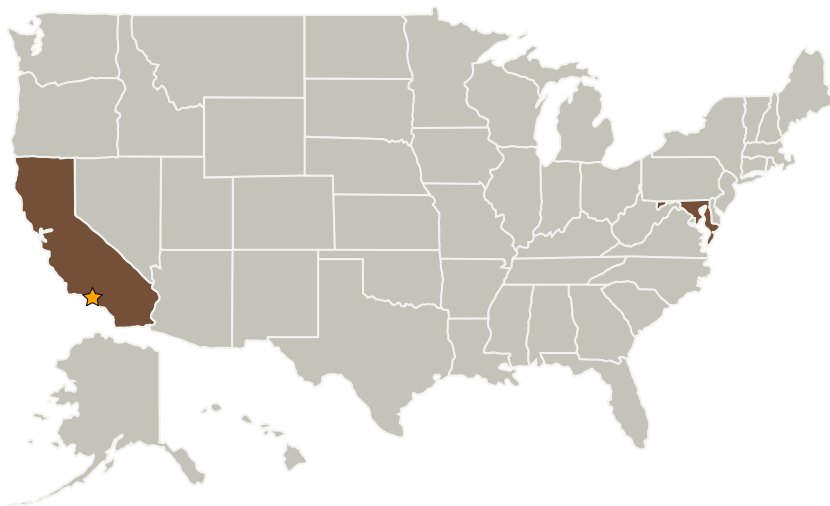
Completed Technology Project (2004 - 2004)



Project Introduction

We propose the development of a CTE-matched, liquid-cooled, high thermal conductivity heat sink for use in spacecraft thermal management applications. The material of construction of this heat sink has four properties that are critical: high normal and specific thermal conductivities, low CTE, high temperature resistivity, and moldability. Its thermal conductivities are higher than that of copper, so the thermal resistance across this heat sink will be lower than one made of copper. At the same time, it has a low CTE, which is slightly less than silicon and close to the CTE's of most semiconductor and optical materials. CTE-matching is critical in space applications because of the wide variations in ambient temperatures, which can lead to delamination of heat sinks from electronics or their fracture. This material can withstand very high temperatures, so a faster CVD diamond deposition process is feasible. The diamond layer maximizes the thermal spreading at the heat sink-device interface (important for devices that are sensitive to temperature gradients) and also provides electrical isolation of the electrical components being cooled. Finally, the material is moldable, so heat sinks with complex external geometries, e.g. curved for optics, and internal surfaces can be fabricated inexpensively.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★ Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
ATEC Inc	Supporting Organization	Industry	College Park, Maryland

Primary U.S. Work Locations	
California	Maryland

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

John S Lawler

Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.2 Thermal Control Components and Systems
 - └ TX14.2.3 Heat Rejection and Storage